Week 4

TEKS Science Standards: TEKS.b.1.A, TEKS.b.2.A, TEKS.b.2.B, TEKS.b.2.C, TEKS.b.2.D, TEKS.b.2.E,TEKS.b.2.F, TEKS.b.3.A, TEKS.b.3.D, TEKS.b.4.A, TEKS.b.4.B, TEKS.b.5.A
TEKS ELA Standards: TEKS.b.1, TEKS.b.2.A, TEKS.b.3, TEKS.b.4, TEKS.b.5, TEKS.b.6, TEKS.b.9, TEKS.b.10, TEKS.b.11.A, TEKS.b.12, TEKS.b.13.B, TEKS.b.15, TEKS.b.15.E, TEKS.b.23.A, TEKS.b.24.A, TEKS.b.27.A, TEKS.b.29

Literature Links

"Antoni Van Leeuwenhoek: First To See Microscopic Life" by Lisa Yount
"What's Smaller Than A Pygmy Shrew?" by Robert E. Wells
"Close, Closer, Closest" by Shelley Rotner and Richard Olivo
"Yikes! Your Body, Up Close!" by Mike Janulewicz
"A World in a Drop of Water: Exploring with a Microscope" by Alvin Silverstein and Virginia Silverstein

Words to Know & Building Academic Vocabulary (BAV)

microscopic	observe	molecule
magnify	compare	atom
field of view	analyze	compound microscope
magnifying glass	record	test tube
lens	findings	microorganism

Page 1 Cover Story
A Microscopic World
TEKS Science Standards: TEKS.b.2.A, TEKS.b.2.B, TEKS.b.2.D, TEKS.b.3.A, TEKS.b.3.D, TEKS.b.4.A
TEKS ELA Standards: TEKS.b.1, TEKS.b.2.A, TEKS.b.3, TEKS.b.12, TEKS.b.24.A

Lesson Suggestions: Explain that matter is made of parts (molecules, atoms, protons, electrons and neutrons) that are too small to be seen without magnification (atomic theory). Give a basic explanation of how microscopes work: by refracting (bending) light waves so that what the eye perceives seems larger, even though it is not. A microscope does not make anything bigger than it is. Show a straw in a clear glass of water to demonstrate this concept. The straw will look broken at the surface, and will seem larger underwater. Provide students the opportunity to look through a microscope. If microscopes are not readily available to your class, get at least one and connect it to your computer, borrow one from a student, other teacher or other school, or acquire one or more through grants or PTA support. The microscopic world is foreign to most students, but it is fascinating to them and will help you inspire even the most reluctant learner's interest. At the very least, project some magnified images using the Internet, or place hand lenses in a center with objects to look at.

Teacher Questions, (Answers) and Cognitive Complexity Level/Relevance Level

- Why do you think scientists use magnifying tools? (Sample answer: Matter consists of particles that are too small to be seen with our eyes only.) LOW/2
- How are magnifying tools important to the world? (Magnifiers help us take a closer look at matter so we can find out more about what it is made of, which will allow us to learn more about it.) HIGH/4
- What is the difference between "looking" and "observing"? (When we observe something, we study

it carefully and notice details that we do not notice when we just take a look.) MODERATE/3

Differentiated Instruction: Instruct four "experts" of varying abilities in how to use microscopes, lights, stages, slides and focus knobs. This is a good job for disengaged or reluctant learners. Show them something really fascinating, like an onion skin or tiny animal, to get them hooked in. Do this before the lesson starts, if possible, maybe during morning work or similar time. Make sure the experts can demonstrate proper microscope use. It is helpful to give the experts 2-3 standard questions to prepare ahead of time that they will ask others, such as, "What do you do if your object is out of focus?" "How do you put the slide on the stage?" The questions can be written on an index card if needed. After the lesson, station at least one expert at each microscope center. The expert instructs the other children about proper use, asks them the prepared discussion questions, helps them discover the answers, then assists them during viewing. At the end of the day, let the experts look at one more cool thing (try chalk or salt) before having them stow the microscopes correctly. The next time a new tool is introduced, pick a new group of experts.

- Add these standards if students completed the activity above: TEKS ELA Standards: TEKS.b.27.A, TEKS.b.29

Pages 2 and 3 Lesson
Magnificent Magnifiers
TEKS Science Standards: TEKS.b.2.A, TEKS.b.2.B, TEKS.b.2.D, TEKS.b.3.A, TEKS.b.3.D, TEKS.b.4.A, TEKS.b.4.A
TEKS ELA Standards: TEKS.b.1, TEKS.b.2.A, TEKS.b.3, TEKS.b.4, TEKS.b.5, TEKS.b.6, TEKS.b.10, TEKS.b.12, TEKS.b.24.A

Lesson Suggestions: Review how a microscope's lens works. Review the difference between "looking" and "observing" and discuss how observing is necessary for scientific study. Have students "observe" a microscope (or image of one) closely. Note that the viewing area is quite small and that an object placed under the lens will often not be able to be seen in its entirety. Discuss that issue with an analogy: Compare a playground or nearby park to a ball field within it. Explain that what a scientist sees is not the whole park; just the baseball diamond, or with a very powerful microscope, just home plate.
Review possible steps in a scientific investigation: ask a question, form a hypothesis, gather materials, follow a procedure, observe, record data, share data in the form of conclusions or life applications.

Teacher Questions, (Answers) and Cognitive Complexity Level/Relevance Level

- What is "field of view"? (Field of view is the area through a magnifying lens or microscope that contains the part of the object that is being observed. We can see more details of that part because of the way the lens refracts light and our eyes perceive it.) LOW/2
- How would scientists solve the problem of having too small a field of view for their purpose? (The scientist could move the object a little bit at a time and record each part, until all of it was observed.) HIGH/4
- What would you say to someone who tells you an object gets bigger under a magnifying glass or through a microscope? (That would be wrong. The fact is that the object isn't getting bigger; the lenses just make the object look bigger and closer). HIGH/4

Differentiated Instruction: Review transition phrases like first, next, last, after that, etc. Point out that these words are used by authors to help us understand sequential text structure. Students work in pairs to identify transitions under the subheading, "Scientific Investigation."
Advanced students can make a digital chart of all the transition phrases they can think of. Print it, present it to the class, and let everyone keep a copy in their writing binder or folder.

- Add these standards if students completed the activity above: TEKS ELA Standards: TEKS.b.15.E

Page 2
Anton van Leeuwenhoek
TEKS Science Standards: TEKS.b.2.A, TEKS.b.2.D, TEKS.b.3.A, TEKS.b.3.D, TEKS.b.4.A
TEKS ELA Standards: TEKS.b.1, TEKS.b.2.A, TEKS.b.3, TEKS.b.12, TEKS.b.24.A

Lesson Suggestions: Use Marzano's questioning sequence to ask questions about details, categories, elaboration and evidence (see questions, below). Start by putting the invention of the microscope into context. Show an image of the painting "The Girl with a Pearl Earring" (1665) by Jan Vermeer. For a good image and kids' resource, see http://makingartfun.com/htm/f-maf-art-library/jan-vermeer-biography.htm. Discuss Vermeer's attention to light/shadow and extreme attention to detail. Explain that details were kind of a fad in the Renaissance. In the 1660s, Jan Vermeer and Anton von Leeuwenhoek both lived in Delft. Although they were in different professions, they were both very interested in the minute details of things. Point out that science, nature, art, engineering and many other fields are interconnected, and that discoveries and trends of the past are a part of STEM (Science, Technology, Engineering, Math) fields and fine arts fields that are still being developed today.

Teacher Questions, (Answers) and Cognitive Complexity Level/Relevance Level
- Detail: What time period is associated with von Leeuwenhoek (and Vermeer)? (late 1600s) MODERATE/3
- Category: What uses did/do microscopes have? (At first, they were used to see small parts of everyday things. Now, super-powerful microscopes can help us detect atomic particles.) HIGH/4
- Elaboration: How has the discovery of the microscope helped other scientists? (Scientists have made medical discoveries like identifying bacteria and germs that cause diseases. This information has helped them develop cures and treatments.) HIGH/4
- Evidence: What clues does the author give to show how microscopes are helpful? (Leeuwenhoek is the "Father of Microbiology" because he used microscopes to study tiny organisms, took notes and recorded his observations, so that others could use his information and tools.) MODERATE-HIGH/3-4

Differentiated Instruction: Do a group WebQuest (use the Internet for research) comparing other scientists and artists or people in other professions who have used similar techniques or tools. Work together to type one page for each comparison. Post a "gallery" of information around the room. Look for sites with varied reading levels, such as Naturescapes at http://eduscapes.com.

- Add these standards if students completed the activity above: TEKS ELA Standards: TEKS.b.13.B, TEKS.b.15.E, TEKS.b.23.A

Page 2
Microscopes
ELA/Literacy Standards Covered: TEKS Science Standards: TEKS.b.2.A, TEKS.b.3.D, TEKS.b.4.A
TEKS ELA Standards: TEKS.b.2.A, TEKS.b.24.A

Lesson Suggestions: Use the pictures to enhance what the text is saying; ask students to label the pictures based on the text. Show different types of microscopes you have gathered, or Internet images of some different types.

Teacher Questions, (Answers) and Cognitive Complexity Level/Relevance Level

- How does the text help us figure out which microscope is which? (Usually text is written in the order the pictures appear, which is from left to right. Clues in the text tell us how many lenses each type of microscope has.) MODERATE/3

Differentiated Instruction: Cut out the Science Tools box from one Student Edition. Have lower-level students cut out the pictures and text and use them to label real microscopes in a center. If none are available, have students cut the three pictures apart and glue them onto a separate paper, then cut out the text that goes with the picture and glue it underneath.
Advanced students can download a photo of a basic microscope, then research what each part of it is called. Make a labeled diagram on a separate paper.

- Add these standards if students completed the activity above:TEKS ELA Standards: TEKS.b.23.A

In the Lab
Mysteries of the Microscopic World
TEKS Science Standards: TEKS.b.2.A, TEKS.b.2.D, TEKS.b.3.A
TEKS ELA Standards: TEKS.b.13.B, TEKS.b.23.A, TEKS.b.24.A

Lesson Suggestions: Cut pictures apart and post each on large paper around the room. Students do a "gallery walk," going from picture to picture and writing what they think it is on the poster paper. Each time an idea is duplicated, the student can simply add a tally mark. Remind students to really observe and not just look. After all students have done the walk and made their votes, reveal what the items are and discuss.

Teacher Questions, (Answers) and Cognitive Complexity Level/Relevance Level

- What specific things did you look at to determine what the item was? (Answers will vary but might include shapes, colors, assumed similarity to enlarged view.) HIGH/4-5
- Why is it surprising to find out what the items really are? (Various answers such as, because the magnified object looks nothing like the whole object.) MODERATE/3

Differentiated Instruction: Using any complex object in the room, drape a small loop of yarn around a section of it and draw that "field of view" in extreme detail. Let others guess what the whole object is.

- Add these standards if students completed the activity above: TEKS ELA Standards: TEKS.b.29

Page 4 Mini-Lab
Take a Closer Look
TEKS Science Standards: TEKS.b.2.A, TEKS.b.2.B, TEKS.b.3.A, TEKS.b.4.A
TEKS ELA Standards: TEKS.b.15, TEKS.b.23.A, TEKS.b.24.A, TEKS.b.29

Lesson Suggestions: Students will be observing, comparing, and contrasting the view of objects when using their eyes and a hand lens. In order to evaluate students' understanding and use of the tools, teachers should look carefully at 1) Vocabulary usage in explanations. Students should report that the objects "look" or "appear" larger. If they report that objects "get bigger" through the lens, that is incorrect. The object doesn't change; our view of the object is what changes. 2) Measurements recorded should not be larger than the lenses. 3) When looking "through eyes," the illustrations would appear smaller and fit inside the square provided. When looking through the lens, the illustration should reflect what is visible in the field of view. It should reach from one end of the lens to the other. Details (scratches, spaces, lines, colors etc.) should be added in this view as well. Provide colored pencils for this activity.

- Some students have had experience with magnifiers, but for some this will be their first investigation. Be sure to teach students proper handling of these tools. Whether the lenses are acrylic or glass, they can be scratched very easily. Students should hold them by the handle only and keep them far enough away from their skin to avoid getting oil on the lenses. When the lenses are dirty, they must be cleaned with lens/eyeglass cleaning paper or a soft cloth. Tell students that they are never to wipe the lenses on their clothing as the fabric, buttons, and other accessories will scratch the lenses, clouding their view.

Teacher Questions, (Answers) and Cognitive Complexity Level/Relevance Level

- Imagine a new student comes to your school. The new student comes from a country where they have no apples or oranges. How would you describe these fruits to someone who had never seen them, felt them or eaten them? (Answers will vary but should describe colors, shapes, scent, textures and flavors. Students should add details such as which has more juice, more mass, edible peel, inedible peel, etc.) HIGH/4
- How will you demonstrate that you are making an observation and not just looking at something? (Observing includes careful study and noting details about the object/substance: taking measurements, finding temperature, weight, mass, testing for other properties like magnetism, pliability, buoyancy, etc., recording what is observed) MODERATE/3
- Imagine that you woke up one morning with magnified vision. How would this affect your day? (Answers will vary. Sample: It would be more difficult to judge distance when walking or looking at things because everything would appear closer than it really is. It would be tricky to follow your regular routine, e.g., eating, dressing, reading.) HIGH/5

Differentiated Instruction: In groups, act out question #3, above.

Let's Investigate
TEKS Science Standards: TEKS.b.2.A
TEKS ELA Standards: TEKS.b.2.A,TEKS.b.12, TEKS.b.23.A, TEKS.b.24.A, TEKS.b.29

Lesson Suggestions: Provide various magnifying lenses and microscopes so that students can try different ones for this activity. Allow children to spread out around the room so that many different objects can be tested and observed.

Teacher Questions, (Answers) and Cognitive Complexity Level/Relevance Level

- Name one of the objects you observed and explain why you picked it. (Answers will vary.) LOW/2
- What new or surprising details did you see under magnification? (Answers will vary but will include things like lines, dots, microorganisms, shapes that look like other things entirely, rough surfaces on seemingly smooth objects, etc.) HIGH/5

Differentiated Instruction: Make up riddles about magnified objects. Write three questions on paper or using digital slide show such as Keynote or PowerPoint (one slide per question, with an image). Others guess what the object is. Example:

I am liquid.
I contain at least four different microorganisms.
I look clear but I am really greenish-brown.
What am I? (a drop of water from the drinking fountain)

- Add these standards if students completed the activity above: TEKS ELA Standards: TEKS.b.9, TEKS.b.15

Writing and Technology
Let's Write: Expository Reflection

- When you have completed this issue of Studies Weekly, record discoveries made while taking a closer look at matter around you. You can do your writing in your Science Notebook. To direct your reflection you may want to use these sentence starters:

The most surprising thing I saw through the lens was ...
The most interesting thing I viewed was ...
The worst thing I saw up close was ...
I had no idea that ...
If I could, I would like to take a closer look at ...

Digital Developments: The teacher may use this as a student product assessment and/or replacement for weekly assessment. MODERATE to HIGH/3 and 4

Web 2.0 Publishing Technology Suggestion(s): Instead of doing a "gallery walk" after children have written their answers for "Mysteries of the Microscopic World," have them work in teams to survey other students about what the photos are, using http://www.polleverywhere.com/
Teams will create a poll, and record what others think the images are. Allow time for each team to project or post their poll. Compare results.

Web Surfers:
http://www.brainpop.com/games/microbes/
http://www.fatlion.com/science/sciencelinks.html
http://www.microscopy.com/Movies/Jaws.mov Visit for a video of a magnified queen ant.